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DEPARTMENT OF DEFENSE

**DEFENSE
LOGISTICS
AGENCY**

Cameron Station,
Alexandria, Virginia 22304 6100

**ECONOMIC ANALYSIS (EA)
SUPPORT FOR AUTOMATED
INFORMATION SYSTEM
CONTROL BOARD (AISC B)
WORKING GROUP**

**PROCEDURAL GUIDELINES FOR
PERFORMING AIS EAs
PART II**

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| <p>These procedural guidelines were developed to provide a standard approach to performing economic analyses for Automated Information Systems (AISs). The purpose was to assist the AISCBS in the Integrated Priority List decision process. The procedural guidelines provide guidance in the performance of an economic analysis for a proposed modification to an existing AIS, or for the development of a new AIS. Also, the guidance contains procedures for both preliminary type economic analyses and more detailed analyses. It defines elements of project life criteria, cost requirements, discounting costs, life-cycle costing, sensitivity analysis and identifying benefits.</p> <p>(Keywords: cost analysis, sensitivity analysis, benefit analysis)</p> | | | | |
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DEFENSE LOGISTICS AGENCY

HEADQUARTERS

CAMERON STATION

ALEXANDRIA, VIRGINIA 22304-6100

DLA-LO

FOREWORD

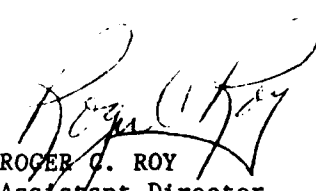
In the Defense Logistics Agency, a number of automated information systems, (AISs) are being proposed to replace or modify existing DLA information systems. Each new development or modification to an automated (or manual) information system requires an economic analysis (EA).

The procedural guidelines were developed to provide a "standard" approach to performing and reviewing automated information systems economic analyses in order to expedite the integrated priority list decision making process and improve the effectiveness of the Automated Information Systems Control Board (AISCBS) Working Group mission. These guidelines, however, are not intended to be a universal blueprint for all AIS economic analyses.

The procedural guidelines have been divided into two phases of the EA process. Phase I guidelines provide guidance in identifying cost and benefit factors and in performing a preliminary economic analysis for each proposed AIS under consideration. Phase II guidelines provide guidance in performing a detailed economic analysis of the preferred AIS alternative for the AIS project.

The guidelines outline the steps of a standard AIS EA approach taking into account the objective, assumptions, alternatives, cost/benefit analysis, alternative preference ranking, and sensitivity analysis.

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ROGER C. ROY
Assistant Director
Policy and Plans

Economic Analysis (EA) Support For
Automated Information System Control Board (AISCB) Working Group

Part II

Procedural Guidelines For Performing AIS EAs

May 1987

Ms. Janet W. Rider
Mr. Richard E. Baker
Operations Research and Economic Analysis Office
Headquarters, Defense Logistics Agency
Cameron Station, Alexandria, Virginia

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I. INTRODUCTION. The procedural guidelines have been developed to assist the Automated Information Systems Control Board (AISCB) in the Integrated Priority List (IPL) decision process. The procedural guidelines provide guidance in the performance of an economic analysis for a proposed modification to an existing Automated Information System (AIS) or for the development of a new AIS. For more detailed information on performing an economic analysis, refer to DLAM 7041.1, Economic Analysis. These guidelines are divided into two different areas of the IPL process and are defined below as phases of the economic analysis.

A. PHASE I. Phase I begins after the management requirements for one or more proposed AIS alternatives for an AIS project have been approved and initial estimates of costs have been provided by a central design activity (e.g., the DLA Systems Automation Center (DSAC)). The Phase I procedural guidelines provide guidance in identifying cost and benefit factors and in performing a preliminary economic analysis for each proposed AIS under consideration. The preliminary economic analyses, submitted along with the management requirements, provide the AISCB with the discounted costs of each proposed AIS over the life of the project. The identification of potential benefits provides the AISCB with further insight into the purpose of each proposed AIS and what can be gained from its implementation. These economic factors, along with noneconomic factors, aid the AISCB in making decisions concerning the selection of the proposed AIS alternative for the AIS project.

B. PHASE II. Phase II begins when the functional description for the chosen AIS alternative of the AIS project under consideration has been developed and cost estimates have been further refined by the central design activity. The procedural guidelines in Phase II provide guidance in performing a detailed economic analysis of the proposed AIS alternative of the AIS project. The economic feasibility of the proposed AIS is analyzed and conclusions are drawn from the results of the EA. Then, the AISCB uses this information for review and update of the IPL ranking of the AIS project, along with the noneconomic factors which are not included in the EA. Several reviews may be made by the AISCB. Each time that an AIS project is up for review, the EA should be updated, if necessary, to reflect any changes in costs.

II. TYPES OF ECONOMIC ANALYSES. If a current information system (automated or manual) exists, it is considered a viable alternative. It should be included in an economic analysis as a standard for comparison purposes. Economic analyses which include the current alternative are called "Type I" analyses. If no current information system exists, the economic analyses are referred to as "Type II" analyses. These procedural guidelines have been developed for "Type I" analyses.

III. PROCEDURAL GUIDELINES FOR PHASE I PRELIMINARY ECONOMIC ANALYSIS

A. Overview of Preliminary Economic Analysis. A preliminary economic analysis is performed for each proposed alternative of the AIS project under consideration in Phase I to test initial estimates of costs and to provide input to the IPL decision making process. The following areas are given consideration in the Phase I guidelines.

1. Establishing the project life of AIS proposal(s).
2. Defining required cost data.
3. Discounting costs.
4. Determining pertinent cost information.
5. Performing a sensitivity analysis on initial cost estimates.
6. Identifying benefits.

B. Establishment of Life Criteria. The following life periods should be established in the preliminary economic analysis.

1. Project Life. The project life includes the leadtime years plus the economic life of the AIS.

a. The leadtime years begin when the management requirements and the results of the Phase I preliminary economic analysis are presented to the AISCB.

b. The economic life begins when the proposed AIS is in full operation. The length of the economic life should equal eight years.

c. If the proposed AIS implementation entails several phases, the project life should equal the time elapsed up to last phase plus eight years.

2. Equipment Life. Generally, DLA economic policy prescribes an equipment life of eight years. More detailed information is provided in DLAM 7041.1, Economic Analysis, Chapter 3.

3. Software Life. The application software life should be the same as the economic life of the proposed AIS.

C. Defining Cost Requirements. Costs required to operate and maintain the current information system should be defined and initial estimates of the required costs for each of the proposed AISs should be determined. There are two types of costs:

1. Nonrecurring Costs. The following costs, if applicable, are nonrecurring (one-time) costs which are incurred in an AIS project:

- a. System definition and design
- b. ADP and telecommunications equipment
- c. Site preparation
- d. System development
- (1) Application software development

- (2) System documentation
- (3) Contractor support
- (4) Travel
- (5) Training
- e. Furniture
- f. ADP equipment replacement
- g. ADP supplies

2. Recurring Costs. The following costs, if applicable, are recurring (annual) costs which are required to operate and maintain a manual or automated information system.

a. Personnel costs for those personnel directly involved in using the information system should include:

- (1) Annual salary
- (2) Fringe benefits of 36.2% of salary
- (3) Management overhead of 10% of salary

b. ADP equipment maintenance which includes:

- (1) Cost of maintenance contract, if one exists;
- (2) Personnel costs, if no maintenance contract exists.

c. Application software maintenance which includes:

- (1) Cost of maintenance contract, if one exists;
- (2) Central design activity personnel costs if no maintenance contract exists or if maintenance contract does not include updates or enhancements to application software.

d. Miscellaneous which includes:

- (1) ADP supplies
- (2) Travel

e. Recurring costs incurred for the proposed AIS during the leadtime years are the same as those of the current information system. Thus, the recurring costs incurred during leadtime are considered equal for all alternatives and are eliminated from the economic analysis. All recurring costs during the economic life are included.

D. Discounting Costs. To perform a comparative analysis over the project life between the current alternative and a proposed alternative, all costs should be discounted to account for the changes in their values due to time. The discount rate represents the opportunity costs of private sector money foregone so that government programs may be funded. Procedural guidelines for discounting are as follows:

1. Discount Rate. DLA currently uses a 10% discount rate, and the factors of the 10% rate are provided in the attached discount tables (A and B) (Appendix A).

2. Discounting Baseline. All costs should be discounted to the current fiscal year. The current fiscal year is referred to as the base year of the economic analysis.

3. Discounted Costs. The discount factor selected must correspond to the year in which the cost is incurred. Take each cost in the economic analysis and multiply it by the appropriate discount factor. Then add the discounted costs for each alternative to obtain the total discounted costs.

4. Discounting Reference. Further information on discounting is provided in DLAM 7041.1, Economic Analysis, Chapters 4-5.

E. Life-Cycle Costing. Calculation of costs over the life of the project is called life-cycle costing. Following are uses of life-cycle costing:

1. Discounting Life-Cycle Costs. Discounting life-cycle costs provides a means of comparing costs between the current information system and the proposed AIS.

2. Cumulative Discounted Life-Cycle Costs. The sum of the discounted life-cycle costs is referred to as the cumulative discounted life-cycle costs and gives the total cost of the proposed AIS over the life of the project. If the cumulative discounted life-cycle costs of the proposed AIS are less than the cumulative discounted life-cycle costs of the current information system, the proposed AIS is economically preferable.

F. Sensitivity Analysis of Initial Cost Estimates

1. Purpose of Sensitivity Analysis. Testing uncertainty in the initial estimate of one or more dominant costs of a proposed AIS may be appropriate to determine the range in which the cost may vary from the initial estimate and still keep the proposed AIS economically acceptable. Costs of the current information system are considered to be actual costs and, thus, should not be tested for uncertainty.

2. Cost Selection. The sensitivity analysis may be performed on any of the costs, but only one type of cost should be varied at a time. If more than one cost is tested at a time, the analysis becomes very complicated and is not as straightforward.

3. Discounted Costs. Varied costs also should be discounted to determine discounted life-cycle costs for each proposed AIS and to compare costs of the current and proposed systems.

4. Uncertainty Test. Determining the range of variation entails varying the initial cost estimate upward until the total discounted life-cycle costs of the proposed AIS are no longer economically preferable to the current system's total discounted life-cycle costs. If the total discounted life-cycle costs of the proposed AIS exceed those of the current system before any cost variations are performed, a range of variation for decreases in an initial cost estimate may be determined. This entails varying the cost downward until the total discounted life-cycle costs of the proposed AIS are economically preferable to the current system's total discounted life-cycle costs. From this downward variation it can be determined if revisions within the proposed AIS can be made and still satisfy the AIS project objective and be economically preferable.

G. Identifying Benefits. Benefits are important economic factors to be considered when determining the economic preferability of an AIS proposal. Since benefits are the measures of output or performance to be gained by investing in a proposed AIS, they should be identified in Phase I and included as input to the AISCBS along with the preliminary economic analysis results and the management requirements. Identification of benefits should be achieved with the aid of the functional development personnel. In Phase I, no attempts should be made to quantify the benefits because not enough information is available to do so. Benefits normally include:

1. Performance Measures

a. Timeliness

(1) Leadtimes

(2) Processing of workload actions

b. Work quality control - e.g., number of processing errors eliminated per a certain number of workload actions

2. Capacity Measures

a. Workload - i.e., number of workload actions processed per unit of time

b. Future expansion

3. Service Measures - Customer Satisfaction.

4. System Reliability - Up/Down Time.

H. Summary of Preliminary Economic Analyses. When the preliminary economic analyses of the different proposed AIS alternatives being considered for a proposed AIS project are completed, the costs and the preliminary economic analyses results should be summarized. The summary of these results is then presented to the AISCBS Support Group for further analysis in the alternative selection process. The cost estimates of the AIS alternative which is chosen at this point in time to be included in a detailed economic analysis are forwarded to the central design activity by the AISCBS Support Group for further refinement. The summary of the preliminary economic analyses should include the following results for each proposed AIS analyzed. These results serve as input to the decision making process.

1. The cumulative discounted life cycle costs. The least costly alternative is the most economically preferable.

2. The economically acceptable/nonacceptable percent variations in those initial cost estimates tested in the sensitivity analysis. Those costs sensitive to any variation from the initial estimate should be analyzed further by the decision maker.

3. Benefits identified. When costs vary minimally between alternatives, the proposed AIS with the benefits identified that best satisfy the requirements of the proposed AIS project should be considered economically preferable.

IV. PROCEDURAL GUIDELINES FOR PHASE II DETAILED ECONOMIC ANALYSIS

A. Overview of the Detailed Economic Analysis. In Phase II, a fully detailed economic analysis is performed for the AIS alternative of choice for an AIS project. The economic analysis elaborates on cost and benefit data requirements, employs various measurement techniques in analyzing costs and benefits, and draws conclusions based on the results of the economic analysis. The results of the economic analysis aid the AISCBS in reviewing and ranking the AIS project within the IPL. The economic analysis may be updated each time the AIS project is to be reviewed by the AISCBS. More detailed information and guidance may be found in DLAM 7041.1, Economic Analysis. The framework of the detailed economic analysis includes the following in order of occurrence:

1. Statement of Objective.
2. Formulation of Assumptions.
3. Description of Alternatives.
4. Estimation of Costs and Benefits.
5. Comparison and Rank Ordering of Costs and Benefits.
6. Sensitivity Analyses of Costs and Assumptions.
7. Conclusions.

B. Objective Statement. The objective is an unbiased statement comprising one or two sentences and should include the following:

1. The purpose for which the AIS project is under consideration.
2. Requirements to be satisfied with implementation of the AIS or AIS modification.

C. Assumptions. Assumptions are statements of uncertainty and usually relate to a future occurrence; they are not facts. However, they should be based on sound criteria. Assumptions should be made in order to reduce difficult problems to more manageable ones. These assumptions then provide a foundation upon which to perform the economic analysis. Key assumptions should provide the basis for some of the sensitivity analyses performed later in the economic analysis. Areas of uncertainty which may be considered when making assumptions include:

1. Future workload requirements.
2. Project life.
3. Times to perform workload actions under the proposed AIS.
4. Personnel requirements.

D. Alternatives. Selection of the proposed AIS alternative for inclusion in the detailed economic analysis is determined by the AISCB Support Group. This decision is based on the management requirements and economic/non-economic factors. In addition to the alternative of choice, the current information system, whether it is manual or automated, should be included as an alternative for comparison purposes. The inclusion of the current alternative and the alternative of choice emerged from Phase I.

E. Cost Determination. Phase I procedural guidelines provide guidance in defining costs and life criteria needed for cost determinations. Cost data for the current information system should be obtained from the preliminary economic analysis and adjusted for any minor updates. Investment cost data for the proposed AIS are obtained from the central design activity. Some costs, such as functional personnel costs, will not be provided by DSAC, but should be developed in detail in the economic analysis. Alternate sources of data required to develop personnel costs include Office of Telecommunications and Information Systems (DLA-Z), Office of Comptroller (DLA-C), and applicable functional principal staff elements. Following are procedural guidelines which apply to cost determination.

1. Costs for both alternatives should be discounted to the base year of the project for comparison purposes.
2. Costs incurred prior to the base year of the project life are sunk costs and should not be included in the economic analysis.

3. ADP equipment replacement costs should be included for existing ADP equipment if the equipment life expires before the end of the project life.

4. Inflation in costs should not be considered unless it changes significantly. When needed, instructions for inclusion of inflation in cost determination are provided in DLAM 7041.1.

5. Sources and derivations should be given in detail.

6. When full capacity of hardware (or software) is not utilized and that capacity is shared by other systems then hardware/software costs should be prorated on some basis pertaining to the costs. Relevant data should be obtainable from hardware/telecommunications experts. Following are some examples of bases for prorating costs to the proposed AIS.

a. If the costs of using telecommunications lines are incurred by more than one AIS, the basis for the proration of these costs to the proposed AIS could be peak volume.

b. When the core memory is shared by more than one AIS, then the basis for prorating user costs to the proposed AIS could be core memory requirements.

F. Definition/Allocation of Annual Cost Savings. Annual cost savings should be determined by subtracting the proposed recurring costs from the recurring costs of the current alternative. If the difference is negative, there is no cost savings for that year. For a proposed multiple-site AIS, cost savings may be allocated among the sites if required. Following are some examples of bases for allocating cost savings among multiple sites.

1. When the workload at each workstation is comparable per unit of time, the basis of allocation could be the number of workstations in the AIS.

2. When the workload at each site is known, the basis of allocation of cost savings could be the workload for all sites in the AIS.

To obtain the cost savings to be allocated to a particular site, the discounted cost savings should be multiplied by the site's proration factor. The proration factor represents the fraction of the base used for cost savings allocation at each site.

G. Cost Analyses. As the economic analysis is performed, costs should be analyzed to further assess the economic feasibility of the proposed alternative. Comparison analyses are made between alternative costs; sensitivity analyses are made on uncertainty in certain costs and assumptions of the economic analysis.

1. Comparison Analyses

a. Costs. To perform any cost comparison between the current and proposed alternatives, the costs should be discounted to the base year of the economic analysis. Phase I procedural guidelines provide guidance in discounting costs. Following are the three methods which may be used to compare the costs.

(1) Present value analysis. The present value analysis provides a means of analyzing the economic feasibility of the proposed AIS through discounted life-cycle costing. Phase I procedural guidelines provide guidance for life-cycle costing. In the present value analysis, cost data are organized such that a detailed year-by-year accounting of costs incurred over the life of the project is presented for both alternatives. The cumulative discounted life-cycle costs for the proposed alternative are then compared to the current alternative's cumulative discounted costs to analyze the economic feasibility of the proposed AIS.

(2) Savings/investment ratio (SIR) analysis. To measure the economic soundness of the proposed AIS the ratio of the total discounted annual cost savings plus cost avoidance to the total discounted investment costs is calculated. If the savings-to-investment ratio is greater than one, the investment in the proposed AIS should be considered economically feasible. Further information on SIRs is provided in DLAM 7041.1, Economic Analysis, Chapter 13. Following are procedural guidelines which apply to the SIR analysis.

(a) To calculate the SIR, the attached DoD form, Economic Analysis - DoD Investments, Format A-1 (Appendix B) should be completed.

(b) The SIR should be calculated for the proposed alternative only.

(c) The higher the SIR the more attractive the investment.

(d) The SIR should be one of the factors taken into consideration by the AISC B for the IPL ranking of competing AIS projects.

(3) Cost summary. A cost summary is a summarization of the costs for both alternatives in the economic analysis. The summarization of the costs should provide the AISC B and the AISC B Working Group with a good overview of the cost-effectiveness of the proposed AIS alternative of the AIS project. The cost summary should include comparative data on investment costs, annual operations and maintenance costs, and total life cycle costs.

2. Sensitivity Analyses. Sensitivity analyses may be performed on (1) certain assumptions made in the economic analysis and (2) certain dominant costs of the proposed AIS. These two key factors of the economic analysis contain degrees of future uncertainty and may be tested to see what effect the uncertainties have on the SIR. Following are procedural guidelines for the sensitivity analyses.

a. Costs. In AIS economic analyses, more than likely, personnel costs and certain investment costs will dominate the cost scenario.

(1) Investment costs. Investment costs may change due to modifications in functional description or changes in equipment costs at time of purchase. For the proposed AIS, dominant investment costs should be varied where the amount of variation depends on the degree of uncertainty in the best estimate. While holding the recurring costs fixed, determine what effect these increases and decreases in investment costs will have on the SIR of the proposed AIS.

(2) Personnel costs. Personnel costs for the current information system are considered actual costs and thus should not be varied except when projected workload increases or decreases influence personnel requirements. For the proposed AIS, the personnel costs for the economic life only should be varied. The amount of variation is based on the degree of uncertainty in the best estimate. Then determine what effect increases and decreases in personnel costs have on the SIR of the proposed AIS.

b. Assumptions. Two common assumptions made in economic analyses involve workload and the proposed AIS' project life.

(1) Workload. When personnel requirements are based on projected workload data, the workload should be varied according to the degree of uncertainty in the best estimate. The personnel requirements, personnel costs and cumulative discounted life cycle costs for the current and proposed alternatives are recalculated for each workload variation to determine what effect the variations in workload have on the cumulative discounted life cycle costs. If workload is not used in personnel requirement determination, this sensitivity analysis should be adapted to test the potential of workload growth under each system and the implications for capacity.

(2) Project Life. The economic life of the proposed AIS is eight years. However, leadtime is subject to change if there are changes in the functional description, funding timeframe, or contractual agreement. Since leadtime contains uncertainty, the project life is uncertain. Therefore, the project life of the proposed AIS should be varied by testing the degree of uncertainty in the best estimate. The project life can be tested for uncertainty by varying the leadtime and testing the investment costs during those leadtimes. The SIR is recomputed over the project life for each variation in leadtime.

H. Benefits Determination. Addressing benefits is judgmental. It becomes necessary when there is no significant difference in costs between alternatives and it is not possible to draw conclusions based on costs alone. Then the difference in benefits of both alternatives becomes significant. Phase I procedural guidelines provide guidance in identifying benefits for a proposed AIS. In the economic analysis, these benefits are further classified as quantifiable or nonquantifiable. Following are guidelines for benefit determination.

1. Quantifiable Benefits. Quantifiable benefits should be measured, when possible, as a dollar value, percent or number of units in terms of output or performance. Measurement data, if available, which may be used to quantify benefits include:

- a. Performance times
- b. Workload actions per unit of time
- c. Anticipated workload growth
- d. Lead time reductions
- e. Reduction or elimination of errors
- f. Productivity
- g. Expansion capabilities
- h. Customer needs/satisfaction
- i. Interface capabilities

When necessary, development of quantifiable benefits should be accomplished for both the current information system and the proposed AIS for comparison purposes.

2. Nonquantifiable Benefits. Nonquantifiable benefits are those benefits which cannot be measured quantitatively due to lack of measurement data. However, they are significant to the AIS project objective and should be qualified descriptively for inclusion in the economic analysis.

I. Benefit Analysis. It is much more complex to perform a meaningful benefit analysis than it is to perform a cost analysis. Various techniques, such as using weighted factors to rank benefits, are available for analyzing benefits. An excellent presentation for benefit identification, determination and analysis can be found in Economic Analysis for Decision Making, United States Army Management Engineering Training Agency Course Book, Fourth Printing, January, 1985. Copies are available in the DLA Office of Policy and Plans, Operations Research and Economic Analysis Office (DLA-LO). In addition, refer to the "Cataloging-Tools-On-Line Automated Information System Economic Analysis", August, 1986, which illustrates one method of performing a benefit analysis.

J. Presentation of Economic Conclusions

1. Conclusions concerning the economic feasibility of the proposed AIS are drawn from the results of the AIS EA (see sections G & I). The areas in the EA from which economic conclusions are drawn should be the following.

- a. Present Value Analysis - life-cycle cost comparison.
 - b. SIR - economic soundness.
 - c. Sensitivity Analyses of Certain Dominant Costs and Assumptions - costs and assumptions sensitive to variations in best estimate and their effect on the SIR.
 - d. Benefit Analysis - benefits which best satisfy project objective.
2. The conclusions should include information about the following:
- a. Alternative of choice.
 - b. Important uncertainties.
 - c. Personnel people savings.
 - d. Benefits.
3. The final decision on whether to approve the implementation of the proposed AIS or not is made by the AISC. This decision will be based on both economic and non-economic conclusions.

PROJECT YEAR 10% DISCOUNT FACTORS

| PROJECT YEAR | TABLE A | TABLE B |
|-----------------|--------------------|-------------------------------|
| | DISCOUNT FACTOR | CUMULATIVE DISCOUNT FACTOR |
| 1 | 0.954 | 0.954 |
| 2 | 0.867 | 1.821 |
| 3 | 0.788 | 2.609 |
| 4 | 0.717 | 3.326 |
| 5 | 0.651 | 3.977 |
| 6 | 0.592 | 4.570 |
| 7 | 0.538 | 5.108 |
| 8 | 0.489 | 5.597 |
| 9 | 0.445 | 6.042 |
| 10 | 0.405 | 6.447 |
| 11 | 0.368 | 6.815 |
| 12 | 0.334 | 7.149 |
| 13 | 0.304 | 7.453 |
| 14 | 0.276 | 7.729 |
| 15 | 0.251 | 7.980 |
| 16 | 0.228 | 8.209 |
| 17 | 0.208 | 8.416 |
| 18 | 0.189 | 8.605 |
| 19 | 0.172 | 8.777 |
| 20 | 0.156 | 8.932 |
| 21 | 0.142 | 9.074 |
| 22 | 0.129 | 9.203 |
| 23 | 0.117 | 9.320 |
| 24 | 0.107 | 9.427 |
| 25 | 0.097 | 9.524 |
| 26 | 0.088 | 9.612 |
| 27 | 0.080 | 9.692 |
| 28 | 0.073 | 9.765 |
| 29 | 0.066 | 9.831 |
| 30 | 0.060 | 9.891 |

NOTE: TABLE B FACTORS REPRESENT THE CUMULATIVE SUM OF
TABLE A FACTORS FOR ANY GIVEN PROJECT YEAR.

ECONOMIC ANALYSIS - DoD INVESTMENTS

FORMAT A-1

Summary of Project Costs

[illegible]